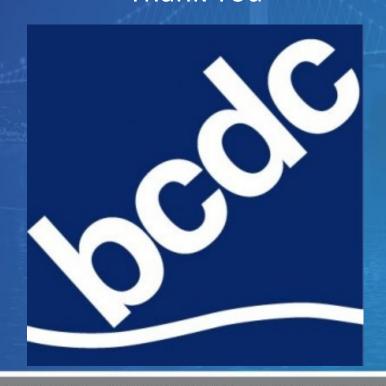




### **Greetings and Introductions**

- Dr. Brian Maroney Chief Bridge Engineer, SFOBB Program
  - Stefan Galvez SFOBB Environmental Manager
     Thank You





### **Our Partners**



























### **BCDC Mitigation Requirements**

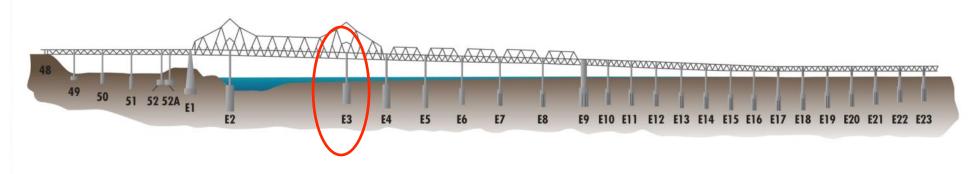
BCDC Permit 2001.008.38, Section II-G

- 1. Blast Attenuation System (BAS)
- 2. Timing of Implosion (Seasonal Avoidance)
- 3. Animal Observers (On Implosion Day)
  - Fish (bird predation, sonar), Birds, Marine Mammals
- 4. Purchase of Mitigation (for longfin smelt)
- 5. Monitoring
  - Fish Trawls, Birds, Hydroacoustic, Test Charge, Water Quality, Rubble Management
- 6. Report to BCDC
- 7. Commission Presentation



### Pier E3 Demonstration Project Area







### Pier E3

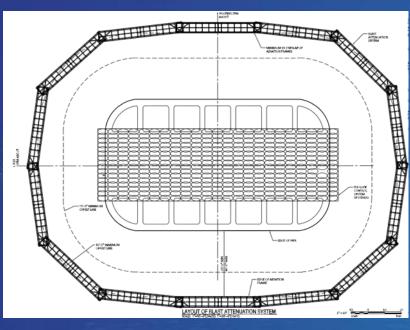
All rubble was disposed in-situ below removal elevation.

Per BCDC
Permit
2001.008.38
Authorization
I-A-5-h





### **Blast Attenuation System**









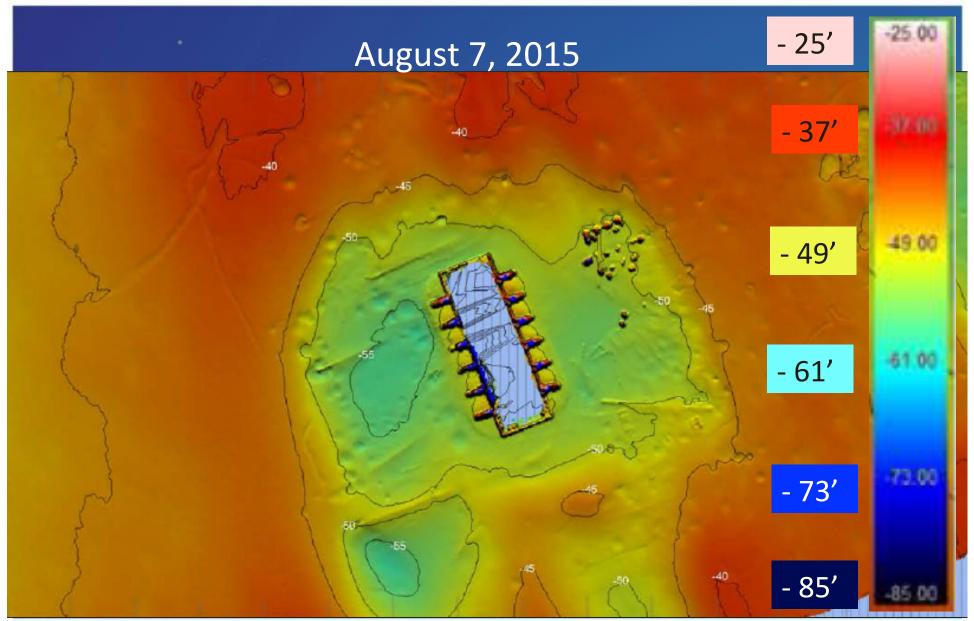
## Implosion Event Video



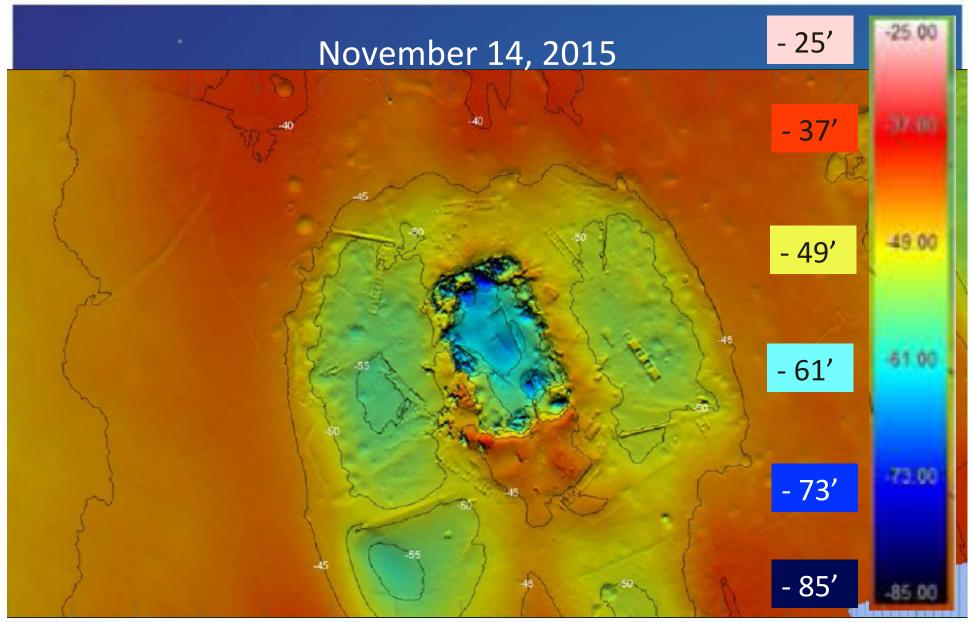




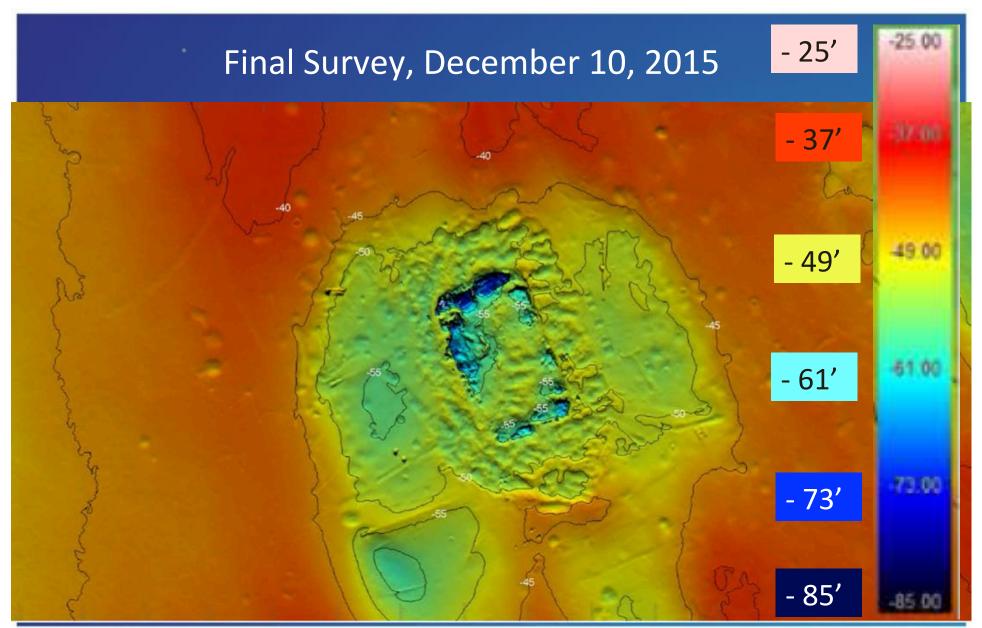






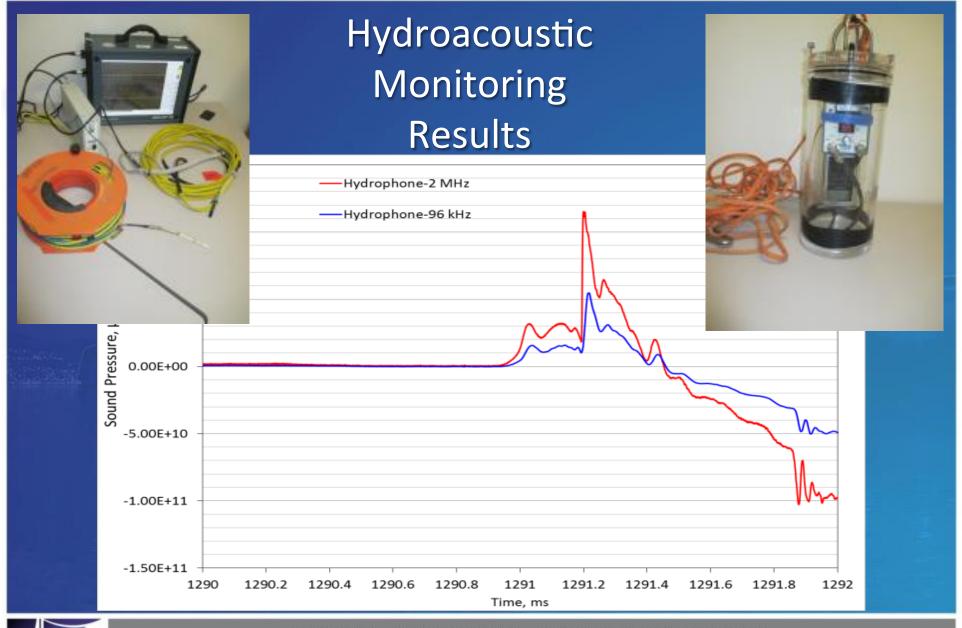






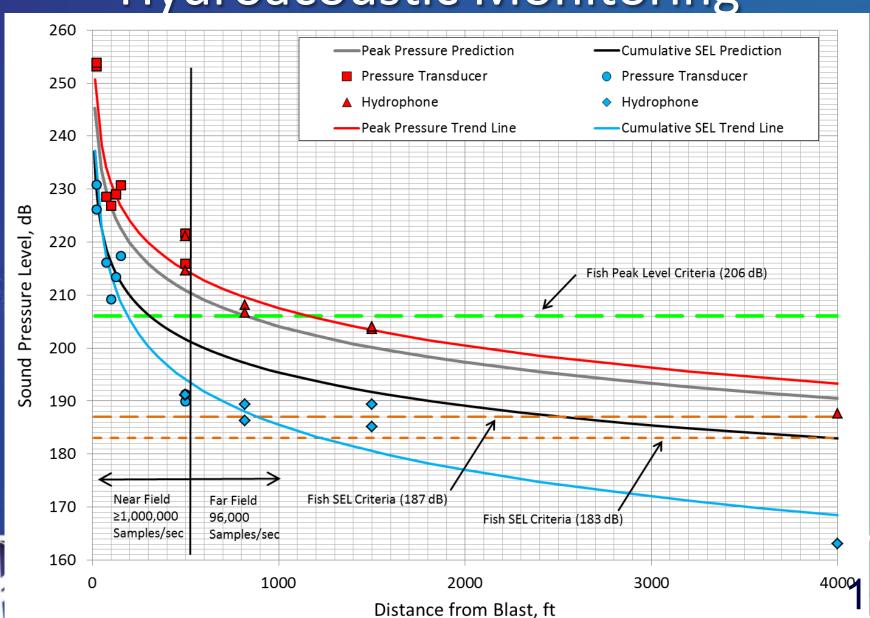






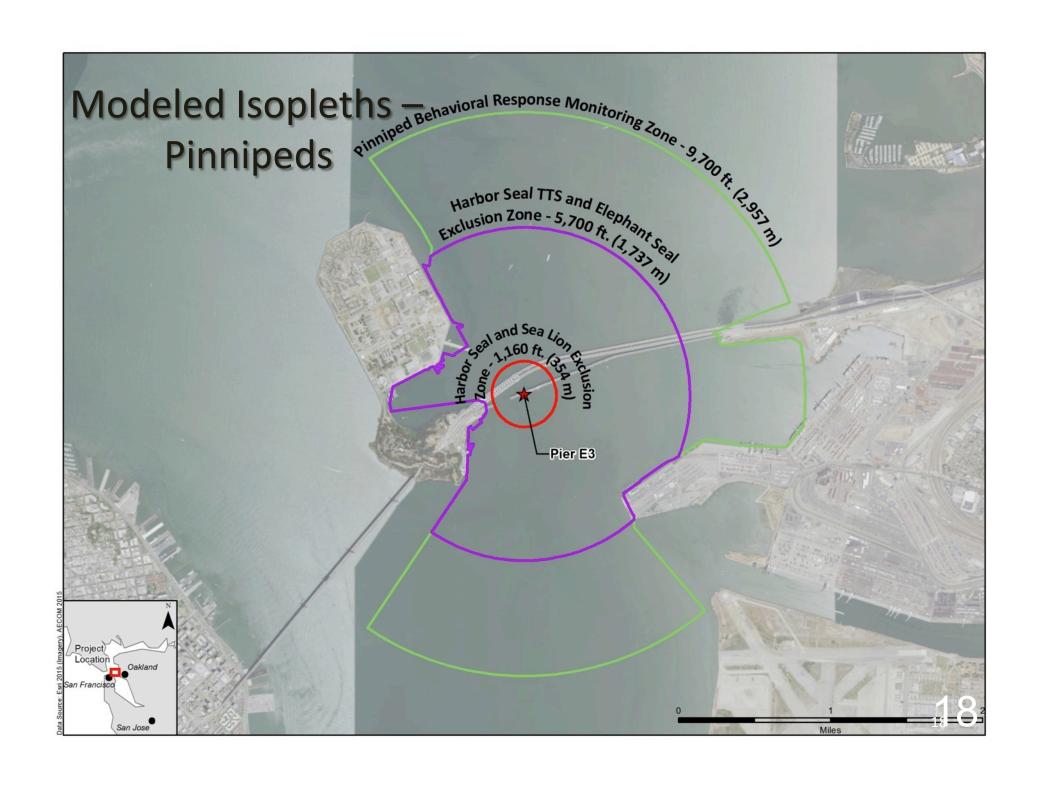


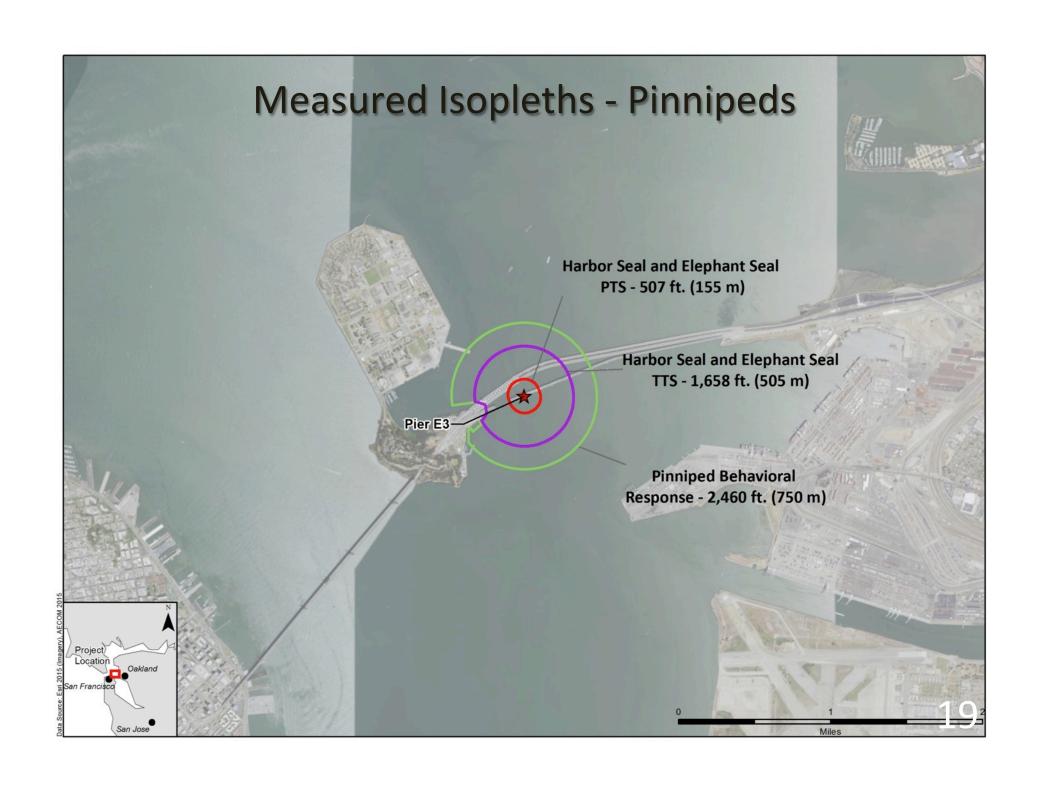
## Hydroacoustic Monitoring

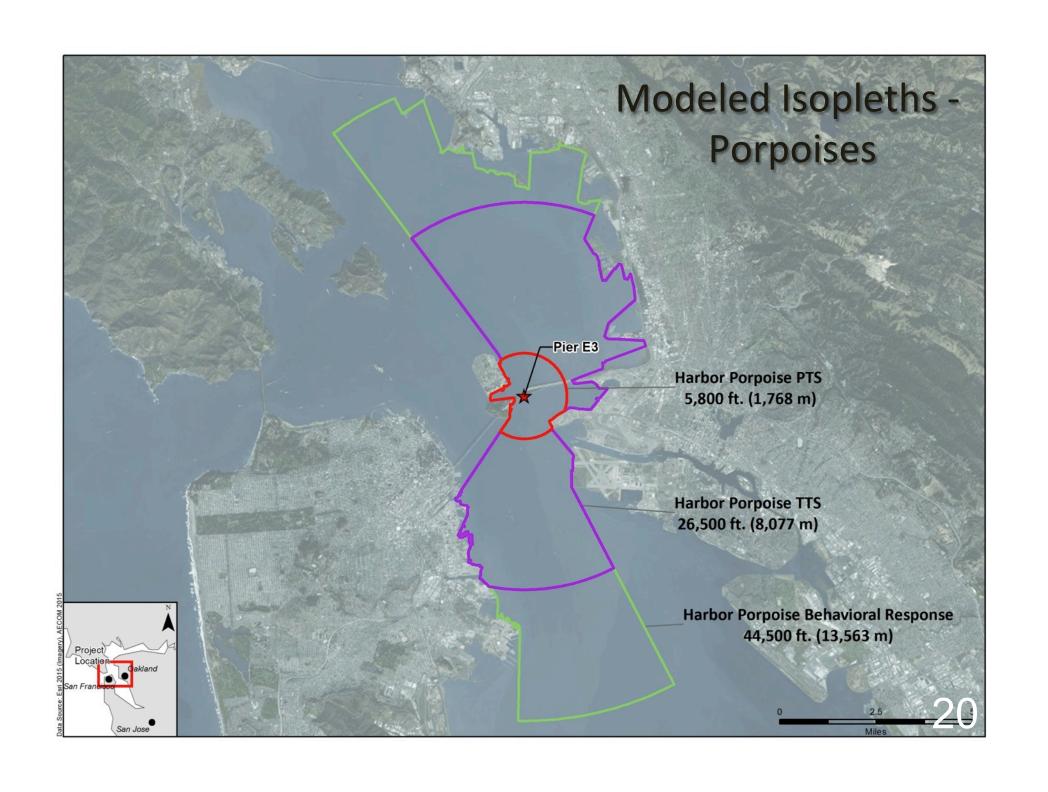


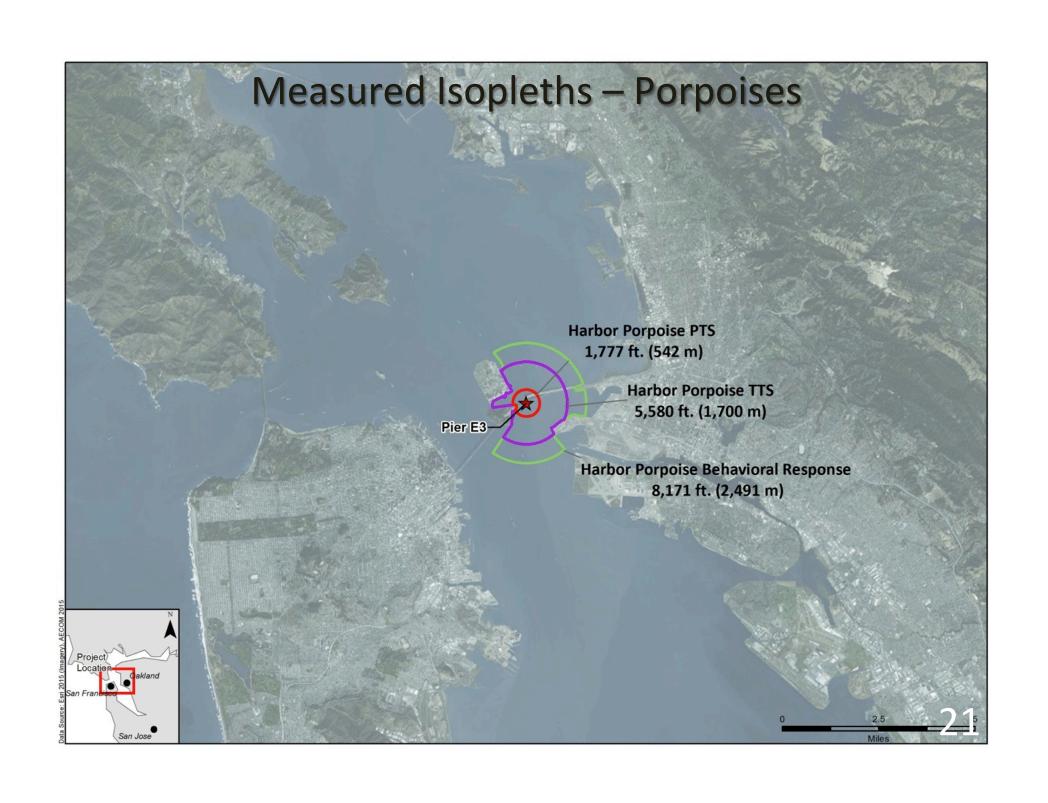
# Modeled Vs. Measured Distances to NOAA Marine Mammal Criteria





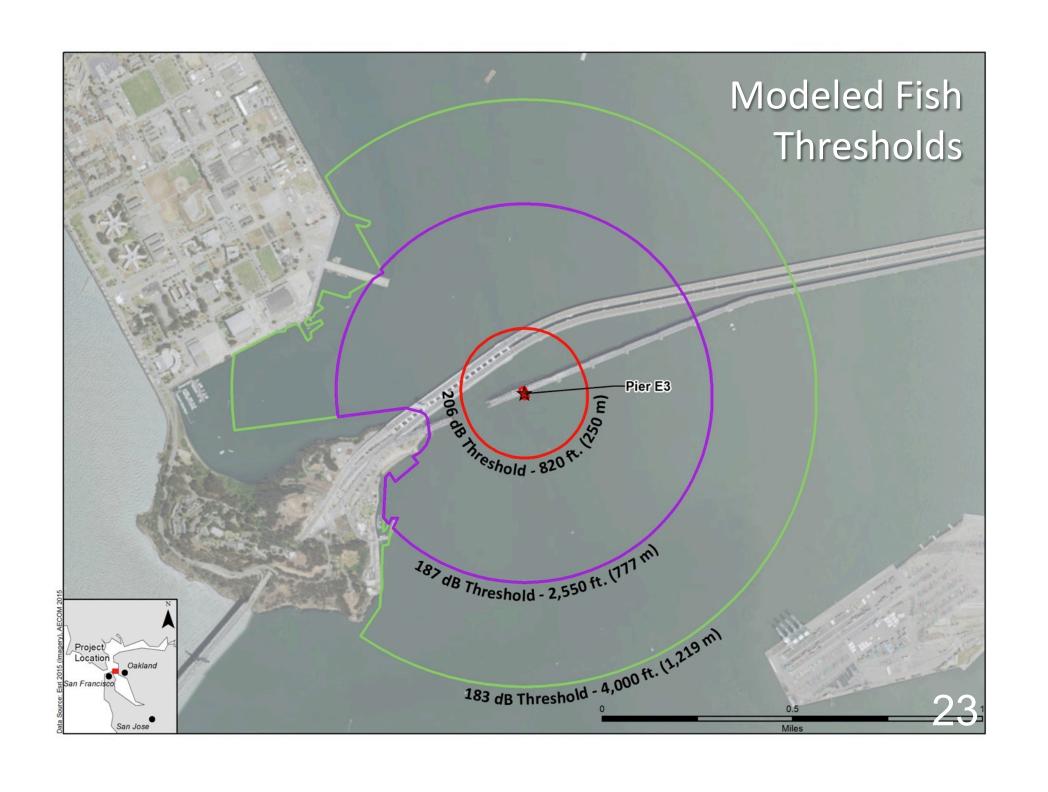


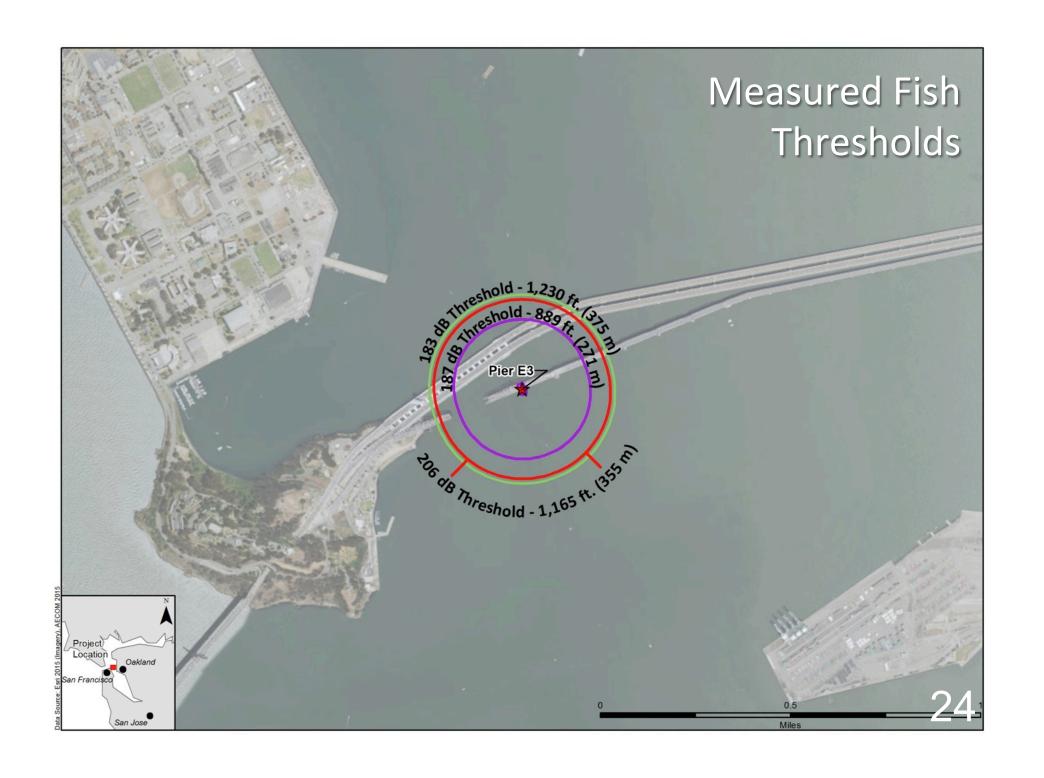




# Modeled vs. Measured Distances to NMFS Fish Threshold Criteria







### **Biological Monitoring Results**

- Birds
- Marine Mammals
- Fisheries



### Bird Monitoring

No diving birds were observed in the 500-foot Watch Zone just prior to implosion





500 ft. Avian Watch Zone (152 m)



# Marine Mammal Monitoring

1 harbor seal observed ~4500′ from Pier E3 seen >30 min prior to implosion



5,700 ft. Elephant Seal Exclusion Zone (1,737 m)

9,700 ft. Pinniped Behavioral Response Monitoring Zone (2,957 m)





### Fisheries Monitoring

- Trawling Study
- Bird Predation
- Caged Fish Study











### Fish Trawling Results

- 1,229 fish collected in 14 trawls
  - 1,158 collected alive(94.2%) and 71collected dead (5.8%)
  - No longfin smelt,
     salmonids, or green
     sturgeon collected

**Trawling Lanes** 



Trawling required by CDFW ITP



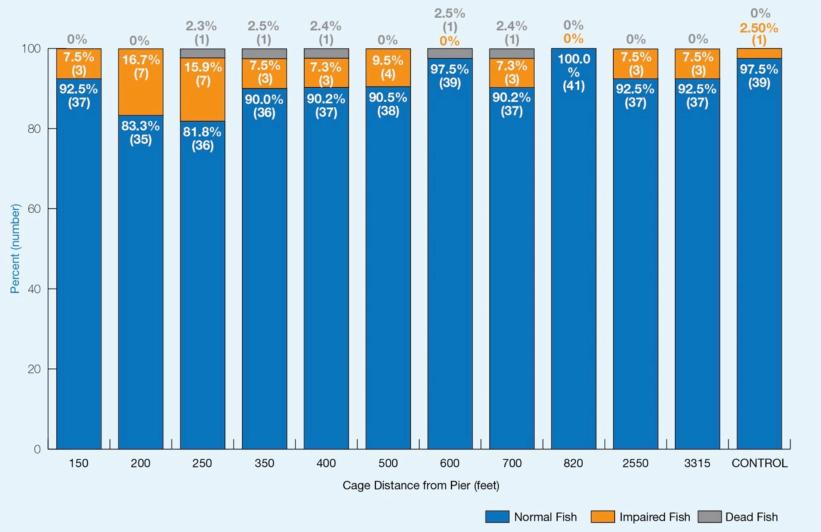
### Bird Predation Monitoring

- Birds attracted by high volumes of organic material and debris present postimplosion
- Bird strikes tapered off after ~1 hour
- 4 fishes were collected from the surface
- No listed species observed or collected
- Necropsies indicated barotrauma was evident in rockfish; no internal damage in surfperch or anchovy

Species	Code	Number	Details on damage
black surfperch	0	1	No damage
anchovy	0	1	No damage
brown rockfish	3	2	Severe hemorrhaging throughout, swim bladder ruptured



### Caged Fish Study Results





### Longfin Smelt Mitigation

#### Liberty Island Conservation Bank and Preserve

Liberty Island, a 186-acre habitat restoration project in Yolo County, California, featured the development of a mosaic of tidal aquatic habitats beneficial to Delta native fish species such as Delta smelt, longfin smelt and salmon.



- Required by CDFW ITP
- Caltrans has delivered letter of assurance for 4 acres of longfin smelt mitigation credits from Wildland Inc's. Liberty Island Conservation Bank (LICB)
- Per BCDC Permit No 2001.008.38,
   Special Condition II-G-4, Caltrans submitted a letter to BCDC staff describing the mitigation site and its monitoring plan
- Caltrans is in process of procuring and transmitting funds

Source: Wildlands Inc., 2016 (http://www.wildlandsinc.com/case\_studies/liberty-island-conservation-bank-and-preserve/)



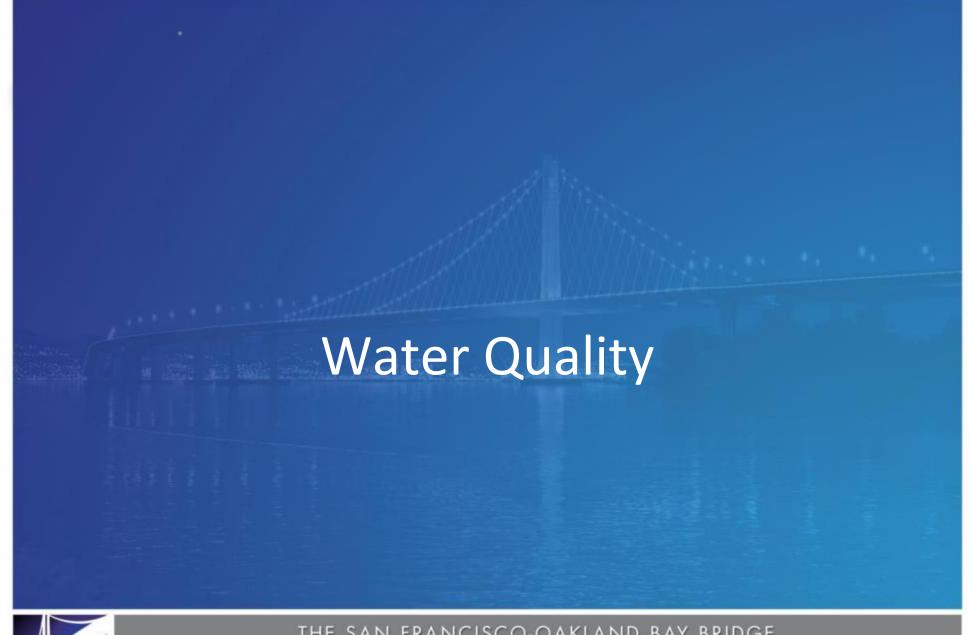
### Liberty Island Conservation Bank

- Construction completed in 2011
- LICB is a 186-acre restored habitat for native fish species including longfin smelt
- Protected with a permanent conservation easement and endowment
- Approved Long-Term Management Plan
- Mosaic of open-water habitat
   Created
  - open water channels (6.68 acres)
  - tidal emergent marsh (34.22 acres)
  - seasonally inundated floodplain habitats (2.71 acres)
- Reconnected 45.11 acres of emergent marsh to tidal influence











### Water Quality Monitoring

**Drogues Delineate Plume** 









Sediment
Samples Test
Benthic
Habitat



Grab
Samples
Measure
Metals





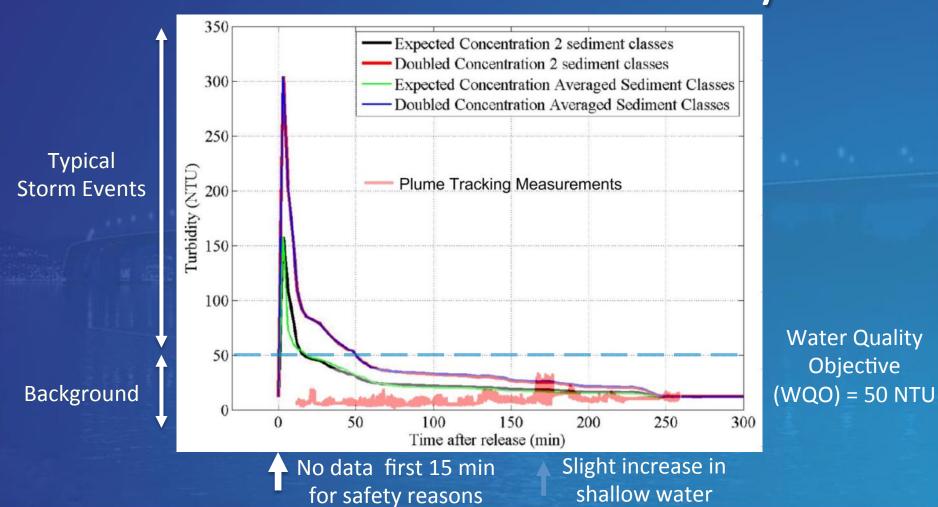
### Based on 20,000 Data Points Collected Between 7:38 AM and 11:33 AM

	рН
Measured: (extrapolated to t=0)	9.0
SF Bay Background	8.0
Water Quality Objectives	6.5 to 8.5; or $\Delta$ 0.5 from background

Safety Project

36

### Sondes Measure Turbidity





THE SAN FRANCISCO-OAKLAND BAY BRIDGE EAST SPAN SEISMIC SAFETY PROJECT

### Additional Mitigation

- Sonar Surveys For Fish and Trawl Areas
- Seasonal Avoidance
- Bay Sediment Sampling and Analysis
- Eelgrass Monitoring
- Test Charge



### Highlights

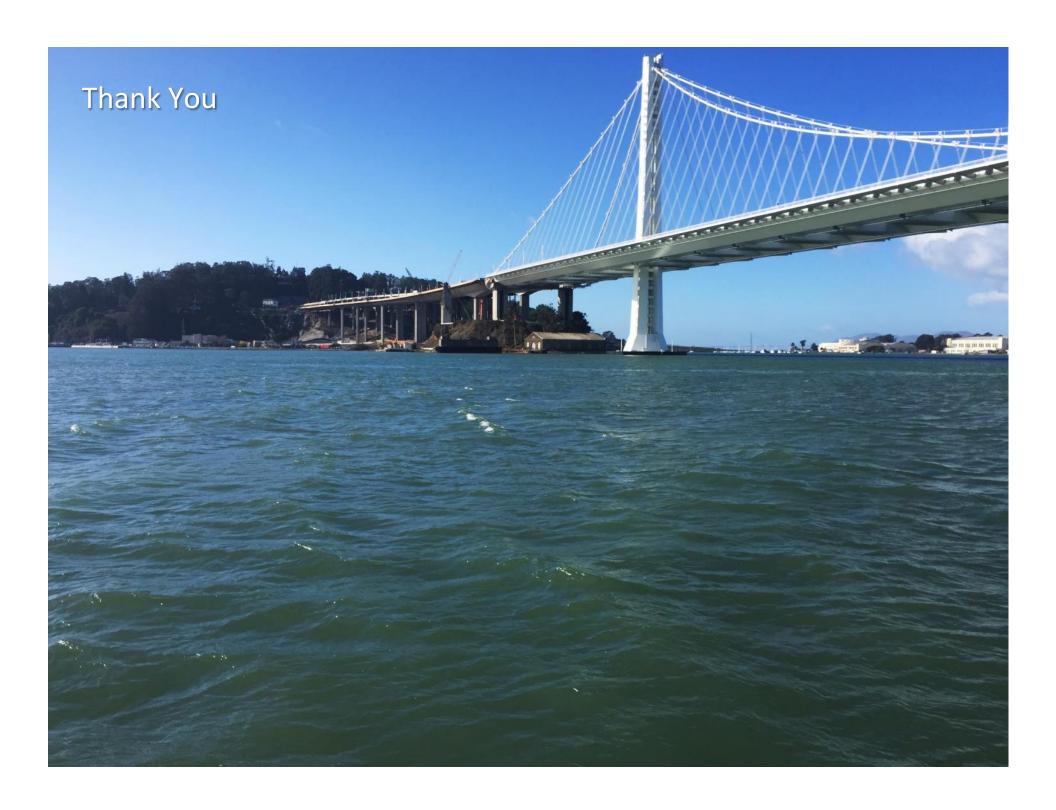
- Pier was successfully imploded into caisson
- ~17,000 CY of open water restored to the SF Bay in 5.3 Seconds
- SAFETY no injuries or near misses
- Significantly lower Sound Exposure Levels (SEL) than modeled
- Slightly Higher peak pressures than modeled
- Lower fish impacts than anticipated, no take of listed species
- No birds or marine mammals were impacted
- Water quality effects were lower and returned to background condition faster
- Conducted with a temporary halt to vehicle traffic, BART tube travel, and boat traffic



## Recommendations and Lessons Learned

- Hydroacoustic Monitoring Comprehensive Plan
  - Additional Instrument Redundancy
  - Enhanced Equipment Reliability
- Improve Bird Predation Monitoring Methods





## BCDC Permit 2001.008.38 Authorizations

#### **Authorization I-A-5**

- e. Remove Pier E3 via controlled implosion
- f. Install a Blast Attenuation System (BAS) around Pier E3
- g. Conduct a caged fish study
- h. Dispose of 16,104 cubic yards of concrete from the implosion in-situ, below mudline
- i. Remove any rubble that can't be placed in-situ to an off site location



### Longfin Smelt Mitigation

- Required by CDFW ITP
- Caltrans Delivered a Letter of Assurance to CDFW For 4 Acres of Longfin Smelt Mitigation Credits
- Per BCDC Permit No 2001.008.38, Special Condition II-G-4, Caltrans submitted a letter to BCDC staff describing the mitigation site and its monitoring plan
- Credits are to be purchased from Wildlands Inc.'s Liberty Island Conservation Bank (LICB)
- Caltrans is in the process of procuring and transmitting funds to Wildlands Inc.

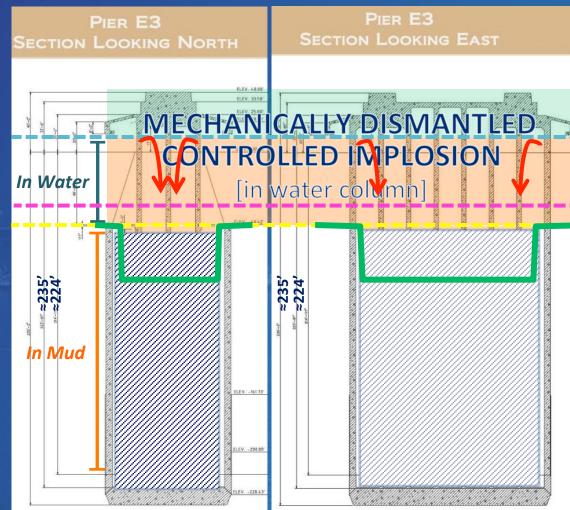


#### **Project Goals**

- Safe and Successful Pier Removal in 4 to 6 seconds
- Restoration of ~17,000 CY of Open Water
- Avoid and Minimize Impacts to San Francisco Bay Resources During Pier Removal
- Refine Existing and Develop Innovative Removal Methods



### Depth/Elevation of Removal





**Scoured Mudline &** 

All rubble was

Removal Elevation [-51']

disposed in-situ below

removal elevation.

Authorization I-A-5-h

Per BCDC Permit

2001.008.38

THE SAN FRANCISCO-OAKLAND BAY BRIDGE EAST SPAN SEISMIC SAFETY PROJECT

MHW +1.5

### November 5<sup>th</sup> Results

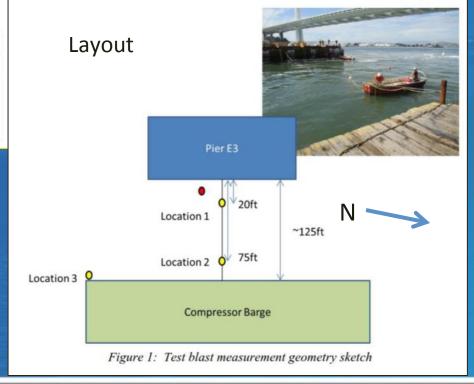
Table 1: Test Blast Noise Levels

Pier E3 Data (20ft from Blast)								
Metric	Blast 1	Blast 2	Reference					
Peak (	207.1	201.9	dB re 1μPa					
SEL	180.9	178.2	dB re 1μPa2-sec					
RMS	192.6	189.2	dB re 1μPa					

Barge Data (75ft from Blast)							
Metric	Reference						
Peak	153.9	157.1	dB re 1μPa				
SEL	136.4	135.9	dB re 1μPa2-sec				
RMS	142.7	149.1	dB re 1μPa				

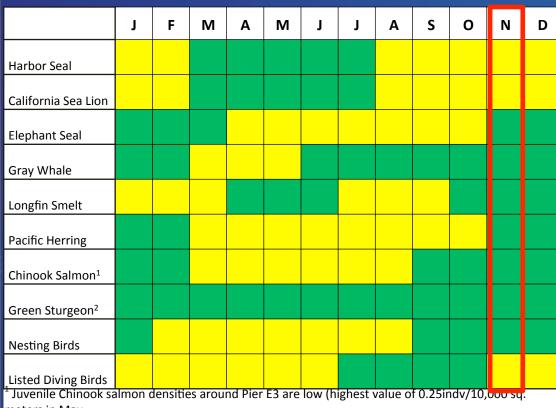
Table 2: Predicted Peak Pressures by Distance

Criteria							
Distance	PEAK Level						
20 feet from blast	235 dB						
88 feet from blast	(206 dB)						
100 feet from blast	205 dB						





### Implosion Scheduled for November



Optimal times for Pier E3 blast based on presence of biological resources.

Green boxes are months when species were not expected around Pier E3 or at low densities.

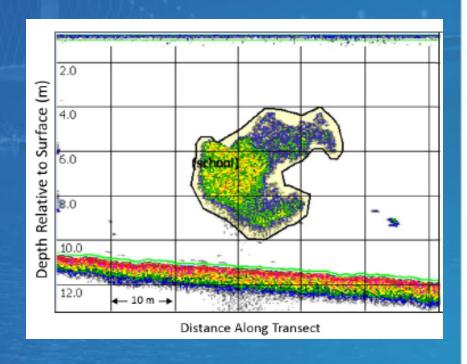


meters in May

<sup>&</sup>lt;sup>2</sup> Green sturgeon have potential to occur around Pier E3 year-round, but in very low densities

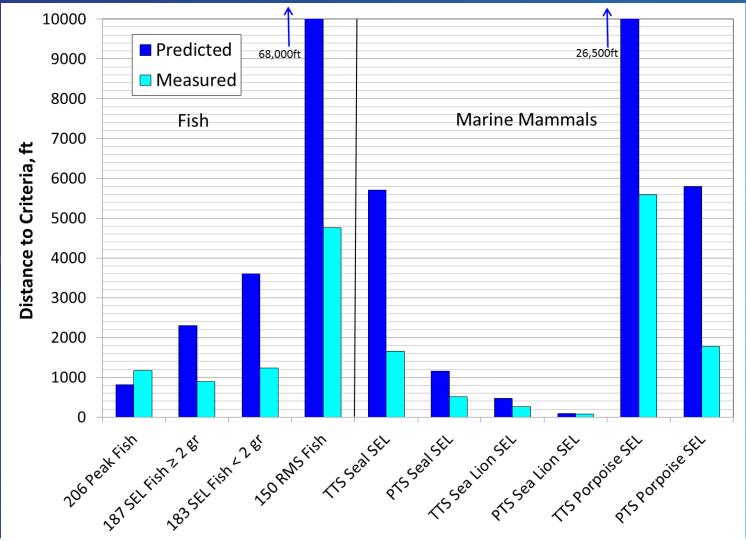
## Fisheries Monitoring – Sonar Assessment

- Fish distribution was similar between north and south areas
- Length mode of individual fish
   ~ 2.5 inches
- Most targets were less than 4 inches in size
- Densities somewhat high in the south area



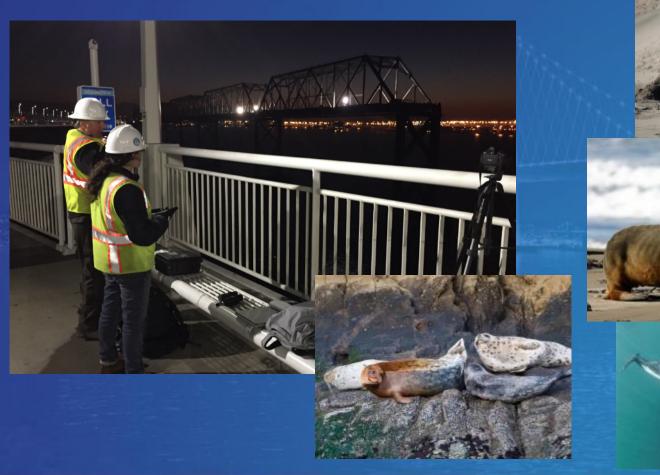


#### Distances to Criteria





### Marine Mammal Monitoring & Results







THE SAN FRANCISCO-OAKLAND BAY BRIDGE EAST SPAN SEISMIC SAFETY PROJECT

### Modeled vs. Measured Distances to NMFS Fish Threshold Criteria

Criteria	Threshold	Modeled Distance (feet)	Measured Distance (feet)			
Peak Pressure	206 dB	820	1,165			
Cumulative SEL ≥ 2g	187 dB	2,550	889			
Cumulative SEL < 2g	183 dB	4,000	1,230			
RMS Sound Pressure Level	150 dB	68,000	4,752			

dB – decibel; SEL – sound exposure level; RMS – root mean square (fish behavioral threshold); g – gram Note: The BAS measured an ~80 percent efficiency in acoustic attenuation based on data from the implosion. Source: I&R 2015



### Water Quality Preliminary Results

- No Detectable Change In Turbidity Observed
- pH (1 Hour Post Blast) Was Elevated Above the Background pH of 8.0, Was Less Than a 0.5 pH Unit Increase

(WQO = 6.5-8.5 or  $0.5 \Delta$  From Background)

- pH Returned to Background Conditions in ~4hrs
- Metals Concentrations Were Comparable to RMP
- Metals Concentrations Were Below Water Quality Objectives
- Final Sediment Results Are Pending Lab Analyses

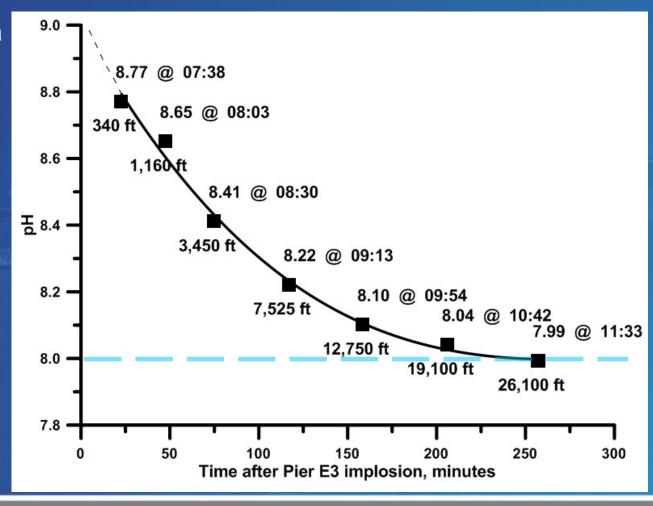


### Sondes Measure pH

Based on 20,000 data points collected over plume from 7:38 AM until 11:33 AM

Extrapolate to t=0

SF Bay Background pH level = 8.0





### Sondes Monitor Eelgrass Beds

- Prediction Was No Impact to Eelgrass Beds
- 5 Buoys Deployed to Monitor pH and Turbidity
- Monitoring Detected No Changes to Water Quality
- Plume Moved Away
   From Eelgrass Beds
   Because of Flood Tide





### Grabs Help Measure Metals

- Metals Measured: Cadmium, Chromium, Copper, Zinc, and Lead
- Results Comparable to Ambient Established by Regional Monitoring Program (RMP)
- No Exceedances of Water Quality Objectives





# Sediment Sampling Tests Benthic Habitat Quality

Pre-implosion Sediment Sampling Completed



Results Indicate Some Pre-implosion Toxicity, Comparable to RMP

Post-implosion Sediment Sample Results Pending





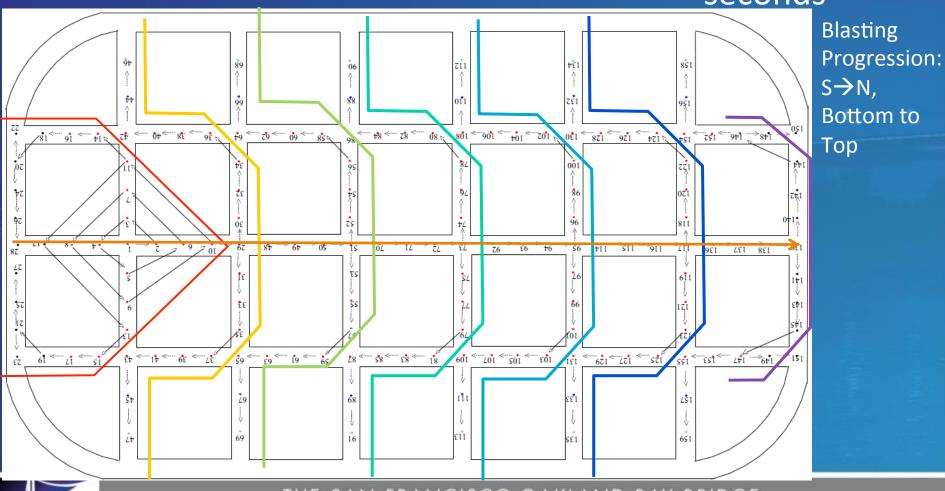
Rubble Noted in Vicinity of Pier E3 Footprint (Within ~50 Meters)

Expect Follow-up Test Within One Year For Continuing Effects On Benthic Sediments



#### Blast Plan

- 588 Controlled Charges
  - Completed in 5.3 seconds



THE SAN FRANCISCO-OAKLAND BAY BRIDGE EAST SPAN SEISMIC SAFETY PROJECT

Caged Fish Study Results

Caged Fish Study - Individual Cage Results - Pier E3 Demolition												
Cage ID	150	200	250	350	400	500	600	700	820	2550	4000	Control
Distance from E3 (m)	45.7	61.0	76.2	106.7	121.9	152.4	182.9	213.4	249.9	777.2	1,010.4	777.2
Distance from E3 (ft)	150	200	250	350	400	500	600	700	820	2,550	3,315	2,550
Fish Exposed (count)	40	42	44	40	41	42	40	41	41	40	40	40
Dead (count)	0	0	1	1	1	0	1	1	0	0	0	0
Dead (%)	0.0%	0.0%	2.3%	2.5%	2.4%	0.0%	2.5%	2.4%	0.0%	0.0%	0.0%	0.0%
Impaired (count)	3	7	7	3	3	4	0	3	0	3	3	1
Impaired (%)	7.5%	16.7%	15.9%	7.5%	7.3%	9.5%	0.0%	7.3%	0.0%	7.5%	7.5%	2.5%
Total Impaired or Dead (Count)	3	7	8	4	4	4	1	4	0	3	3	1
Total Impaired or Dead (%)	7.5%	16.7%	18.2%	10.0%	9.8%	9.5%	2.5%	9.8%	0.0%	7.5%	7.5%	2.5%
Normal (count)	37	35	36	36	37	38	39	37	41	37	37	39
Normal (%)	92.5%	83.3%	81.8%	90.0%	90.2%	90.5%	97.5%	90.2%	100.0%	92.5%	92.5%	97.5%









